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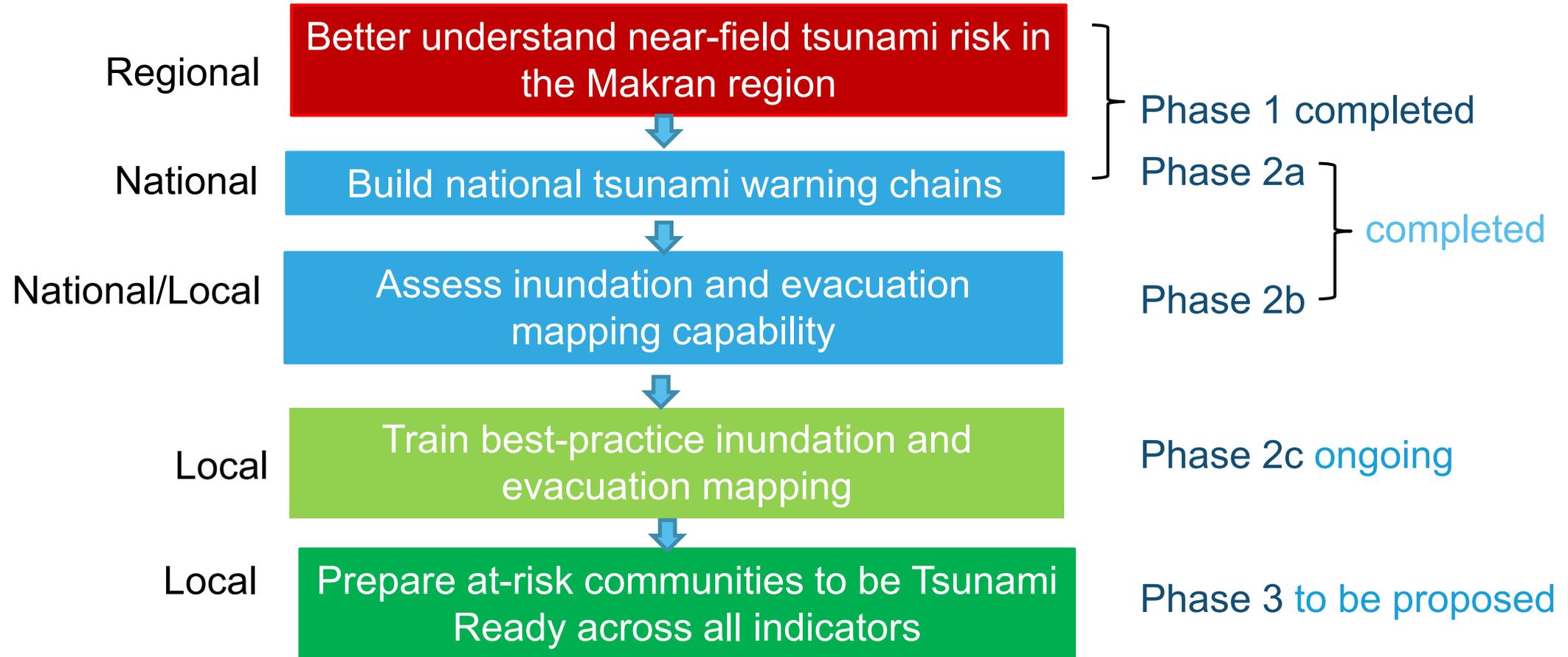
# Strengthening tsunami early warning in the North-west Indian Ocean region through regional cooperation

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*Acknowledgements:  
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# Objectives

## Programmatic Approach



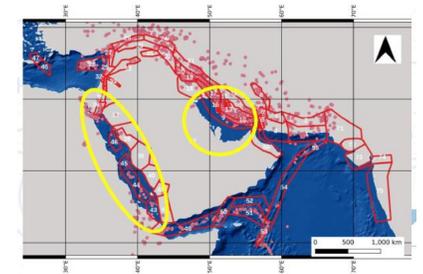
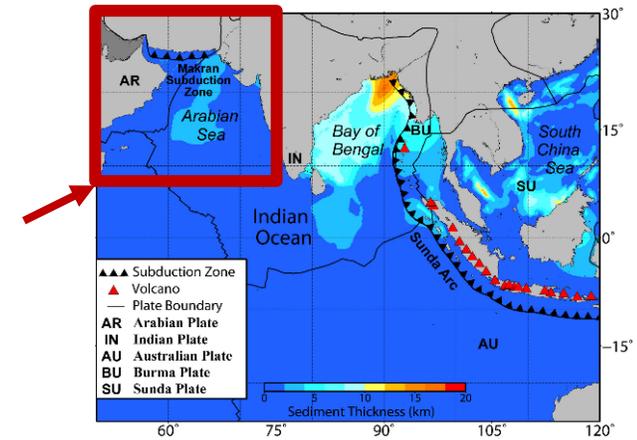
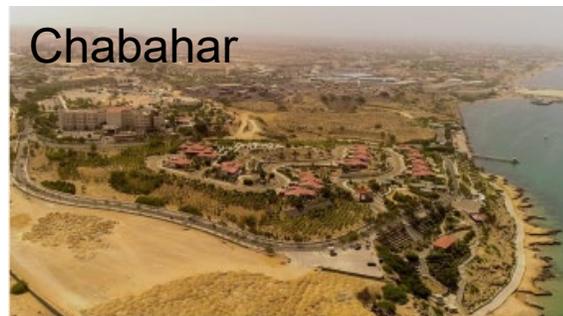
# Risk Assessment

Phase 1 & 2a: Completed (2019-2022)

## Hazard and risk assessments inform countries on preparedness required

Better understanding of the tsunami risk knowledge to inform and underpin warning and mitigation systems in the NWIO to enable appropriate and effective community responses to the tsunami threat.

- **Probabilistic Tsunami Hazard Assessment (PTHA)** has been completed for NW Indian Ocean with additional in-kind support from global tsunami modelling experts from Germany (GFZ), Italy (INGZ), Norway (NGI), and India (INCOIS).
- Indian Centre for Ocean Information Services (INCOIS) will host output and make available for NWIO countries (India, Iran, Pakistan, Oman, UAE).
- UNESCO-IOC Intergovernmental Coordination Group for Indian Ocean Tsunami Warning & Mitigation System (ICG/IOTWMS) will further utilize to include different source mechanisms and expand to whole of Indian Ocean.



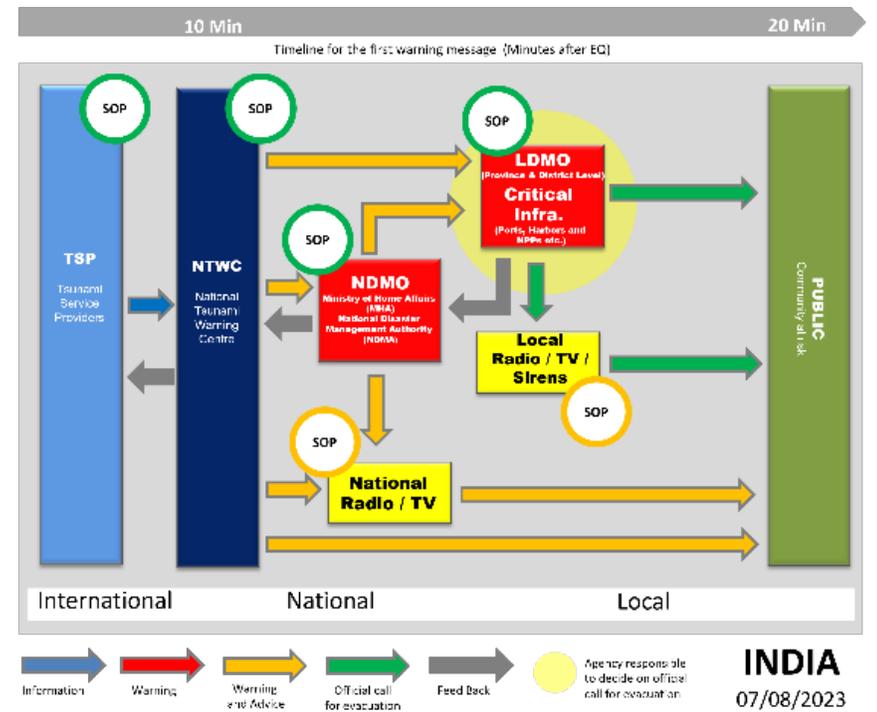
# Tsunami Warning Chains and SOP

Phase 1 & 2a: Completed (2019-2022)

Improvement of warning services at NTWC level and the organization of the national warning chains to assure timely warnings.

**For at-risk communities to respond to the tsunami threat, the warnings must reach all in the community efficiently in the very short time available**

- Each country has different authorities and links in the national tsunami warning chain, therefore the required national stakeholder relationships and working groups were established
- Every link in the national chains (National Tsunami Warning Centre (NTWC), Disaster Management Offices (DMOs), other relevant authorities, broadcast media, and public) and underpinning SOPs have been reviewed and revised through regional and national workshops
- UNESCO-IOC Intergovernmental Coordination Group for Indian Ocean Tsunami Warning & Mitigation System (ICG/IOTWMS) assists countries to test their warning chains and SOPs through tsunami warning exercises in each ocean basin every two years (IOWave)



# Gap Analysis

Phase 2b: Completed (2022-2023)

*Identify where national expertise exists and where capacity development is required*

## Inundation Mapping

- **Regional Working Group for Tsunami Inundation Modelling and Mapping (RWG-TIMM)** was established to help coordinate existing experts in the region and to provide a regional ongoing optimal mass
- **Global experts provided awareness of latest best-practices** and to help identify capacity building requirements
- **Regional workshop “Makran Subduction Zone Science Strengthening Tsunami Warning and Preparedness”**, Abu Dhabi, 14-16 November 2023
- UNESCO-IOC Intergovernmental Coordination Group for Indian Ocean Tsunami Warning & Mitigation System (ICG/IOTWMS) will utilize the identified latest best practices to expand inundation mapping capability across the Indian Ocean



	India	Iran	Oman	Pakistan	UAE
Shallow Water Bathymetry	200 m Res. GEBCO	450 m Res. (15 arcsec GEBCO) Industry data	450 m Res. (15 arcsec GEBCO)?	Variable, 10 m in Pilot Regions	450 m Res. (15 arcsec GEBCO)
DEM	5-10m SRTM	30 m SRTM	SRTM	10 m SRTM	10 m High resolution Satellite Data
Land Use Information	Maps 1:5000	Not available	Not available	Not available	Basic map
Model Used	Tunami-N2 ADCIRC	ComMit GEOWAVE MIKE-21 Tunami-N2	COMCOT	GUITAR TOAST GeoClaw	ComMIT
Type of Studies	Deterministic	Deterministic/ Probabilistic	Deterministic/ Probabilistic	Deterministic	Deterministic

# Output 3: Gap Analysis

*Phase 2b: Completed (2022-2023)*

*Identify where national expertise exists and where capacity development is required*

## Evacuation Mapping

- **National Working Groups for Tsunami Evacuation Planning (NWG-TEP) were established** in each country to help coordinate existing experts in general evacuation mapping planning, who can be utilised to develop tsunami evacuation maps
- **Tsunami Evacuation Planning Information Package** detailing best-practices (translated into Farsi)
- Representatives from each country were supported to attend the **UNESCO-IOC INDIAN OCEAN TSUNAMI READY HYBRID WORKSHOP, 22 – 26 November 2022, in Bali Indonesia**, to further benefit from first-hand experiences and training in best-practices.
- UNESCO-IOC Tsunami Ready Recognition Programme (TRRP) helps countries to make at-risk communities prepared for the tsunami threat



# Hazard and inundation mapping capabilities

*Phase 2c: Completed (2024)*

## Training in development of tsunami inundation maps by enhancing capacities in tsunami modelling

*Muscat, Oman 19 – 23 April 2024*

- Discussed the roadmap for the further implementation and development of the PTHA.
- Prepared local inundation maps: strategy, approach and uncertainties.
- Discussed the role of scientists (modelers) in the implementation of national and local DRR strategies.
- Discussed expectations and needs of evacuation planning from the modelers.
- Presented and discussed the progress inundation modelling in 5 pilot regions around NWIO to be addressed in the TEP meeting.



# Evacuation mapping capabilities

*Phase 2c: Completed (2024)*

**Training in development of evacuation plans to facilitate effective community responses to the threat from near-field and far-field tsunamis.**

*Muscat, Oman 21 – 15 April 2024*

- Reviewed designated hazard and inundation maps
  - Outlining evacuation zone(s)
  - Identifying vulnerable groups and elements
- Worked on the overall evacuation strategy
- Identify evacuation routes and signage requirements
- Defined evacuation procedures
- Discussed features of a public evacuation map
- Discussed methods for consultation and process for approval of a draft TEP
- Discussed strategies and methods to make the approved TEP known and understood by the public
- Discussed policies for exercising and revision processes



# Testimonials

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**Ms Hira Lodi**, Assistant Professor, NED University Karachi, Pakistan

*“The events were fruitful as it was not only a learning experience but also helped develop professional contacts and collaborations are expected in the near future.”*

**Dr Alfred Johny**, Hazard Analyst, Kerala Disaster Management Authority, India

*“Every time we gather, we come to know different experiences of other states and lessons learnt in specific communities. This gave us great opportunity to improve ourselves and take advantage of experienced people on field.”*

**Mr Abdolkarim Haghighi**, Hormozgan Disaster Management Organization, Iran

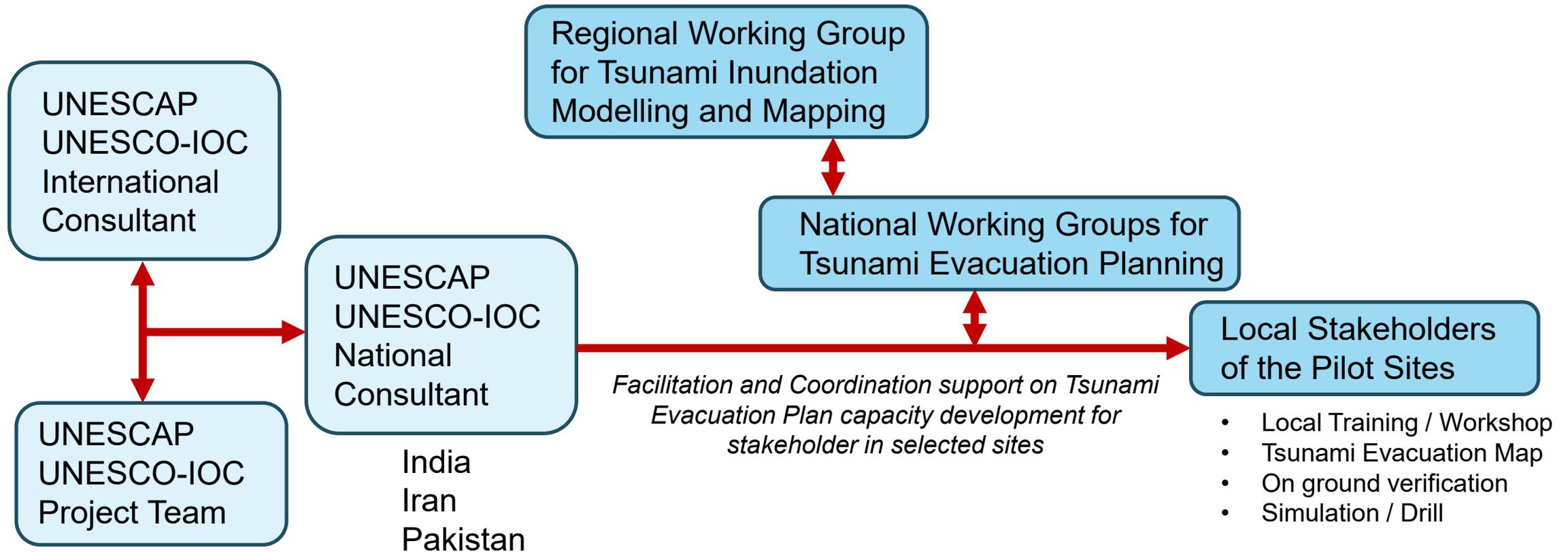
*“I have transferred the experiences of these workshops to my organization and now, besides myself, the entire Hormozgan disaster management team is involved in the activities and a good familiarity with the experiences of other countries has been established.”*



# Strategy for Piloting in Tsunami Evacuation Maps, Plans, Procedures

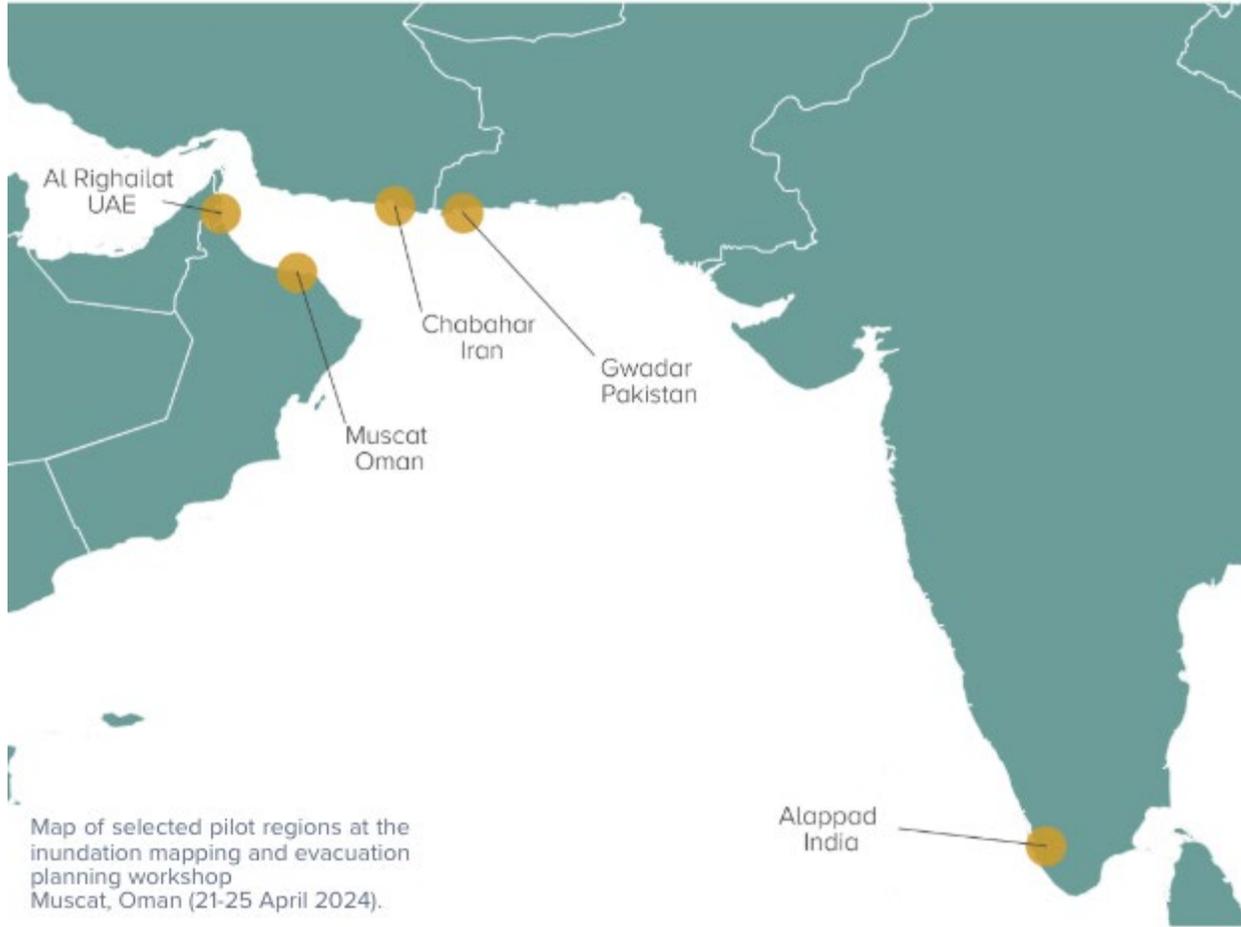
*Phase 2c: Completed (2023-2024)*

Engaged with National Consultants to support the facilitation coordination at the local level to Pilot Tsunami Evacuation maps, plan, and procedures in selected sites in each country.



# Piloting Tsunami evacuation plans in communities

*Phase 2c: Completed (2023-2024)*



## India

- Evacuation maps developed in 9 coastal areas of Kerela.
- Community evacuations undertaken
- Signage and information boards underway.

## Iran

- Evacuation maps finalised and signboards designed for Jask.
- Maps sent for LDMO and NDMO approval

## Pakistan

- Evacuation drills conducted in two schools in Gwadar for World Tsunami Awareness Day.

# Translate Manual and Guides

Phase 2c: Completed (2023-2024)

Engaged with National Consultants to support the translation of UNESCO-IOC Manuals and Guides.



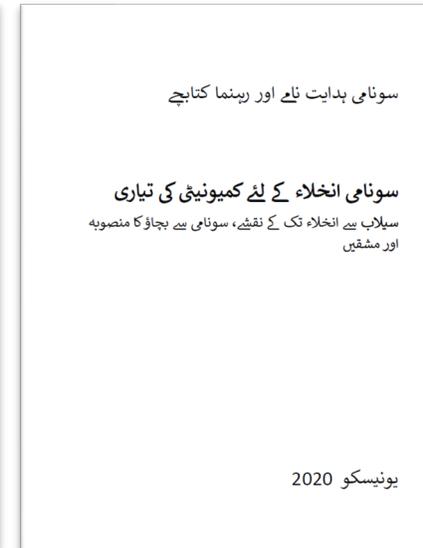
Translation of MG 74  
(Tsunami Ready) to Farsi



Translation of MG 82  
(Preparing For Community  
Tsunami Evacuation) to  
Farsi



Translation of MG 74  
(Tsunami Ready) to Urdu



Translation of MG 82  
(Preparing For Community  
Tsunami Evacuation) to  
Urdu



The Karachi Folio  
Impact of 1945 Tsunami to  
Urdu

# Tsunami Evacuation Maps, Plans and Procedures Training

Phase 2c: Ongoing (2025)

**Organize TEMPP training capitalizing on lessons learnt of the Makran and Eastern Indian Ocean regions' experience toward the implementation of Tsunami Ready for better Indian Ocean Tsunami Resiliency**

- Tsunami Inundation Modeling and Mapping (TIMM): 3 days
- Tsunami Ready Recognition Programme (TRRP): 3 days
- Tsunami Evacuation Maps, Plans and Procedures (TEMPP): 5 days

## Training Workshop on Tsunami Evacuation Maps, Plans, and Procedures and the UNESCO-IOC Tsunami Ready Recognition Programme for the Indian Ocean Member States

15-23 April 2025

UNESCO Category 2 Centre, International Training Centre for Operational Oceanography (ITCOcean),  
Indian National Centre for Ocean Information Services (INCOIS),  
Hyderabad, India

Monday 14 April 25	Parallel Sessions			Joint Session						
	Day 1 Tuesday 15 April 25	Day 2 Wednesday 16 April 25	Day 3 Thursday 17 April 25	Day 4 Friday 18 April 25	Day 5 Saturday 19 April 25	Day 6 Sunday 20 April 25	Day 7 Monday 21 April 25	Day 8 Tuesday 22 April 25	Day 9 Wednesday 23 April 25	Thursday 24 April 25
Arrival of All Participants	1	2	3	4	5	Free Day	6	7	8	Departure of all Participants
	Joint Opening	TIMM Day 2	TIMM Day 3	TEMPP (Day 1) Joint TIMM-TRRP	TEMPP (Day 2) Joint TIMM-TRRP		TEMPP (Day 3) Joint TIMM-TRRP	TEMPP (Day 4) Joint TIMM-TRRP	TEMPP (Day 5) Joint TIMM-TRRP	
	TIMM (Day 1)									
	1	2	3							
TRRP (Day 1)	TRRP (Day 2)	TRRP (Day 3)								

Member States Participants: 20 Countries

Australia, Bangladesh, Comoros, India, Indonesia, Iran, Kenya, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, South Africa, Sri Lanka, Timor Leste, United Arab Emirates

# Challenges

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## COVID impacts on travel, especially internationally

- ✓ Overcome through use of hybrid meetings (online and in-person) and use of in-situ national consultants

## Political situation in Iran created communication difficulties and some delays to workshops, etc.

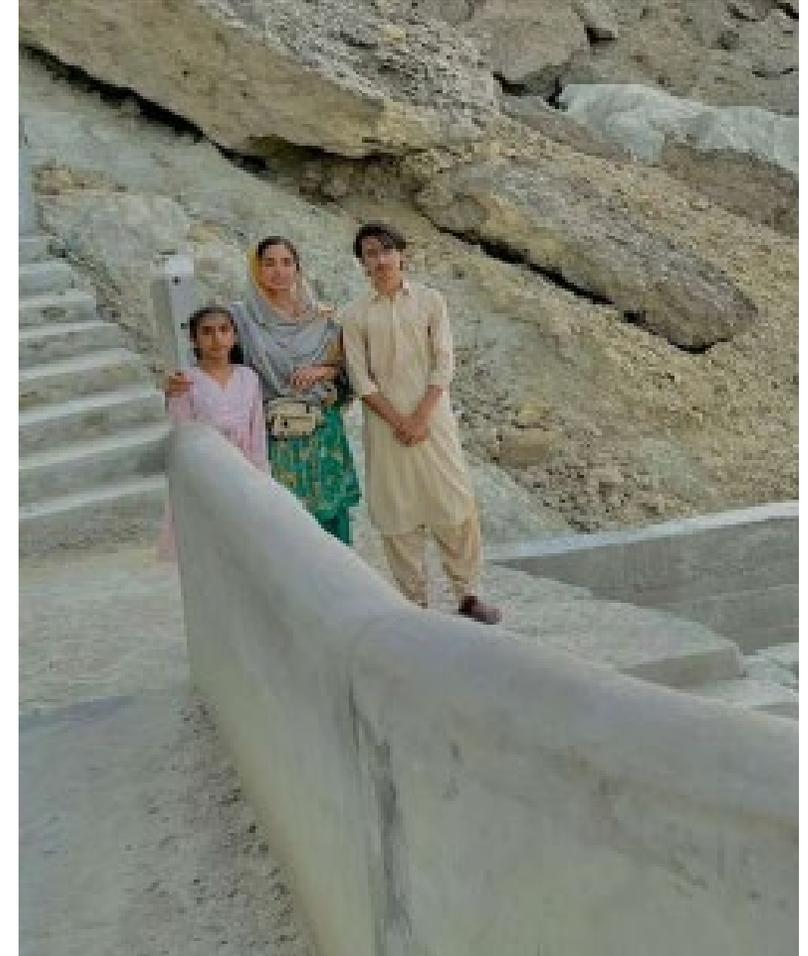
- ✓ Overcome through good will of all national participants and use of in-situ national consultant

## Language difficulties at local level in Iran

- ✓ Overcome through use of translators for meetings and translation of key evacuation planning document

## All inclusiveness

- ✓ Use of hybrid meetings enabled wider outreach to all genders and people with disabilities.
- ✓ Evacuation best practices to be implemented necessitate the engagement of all the community to see ensure evacuation procedures are in place for all.



# Tsunami Ready Implementation in Pilot Sites

*Phase 3: Proposed for 2025-2027*

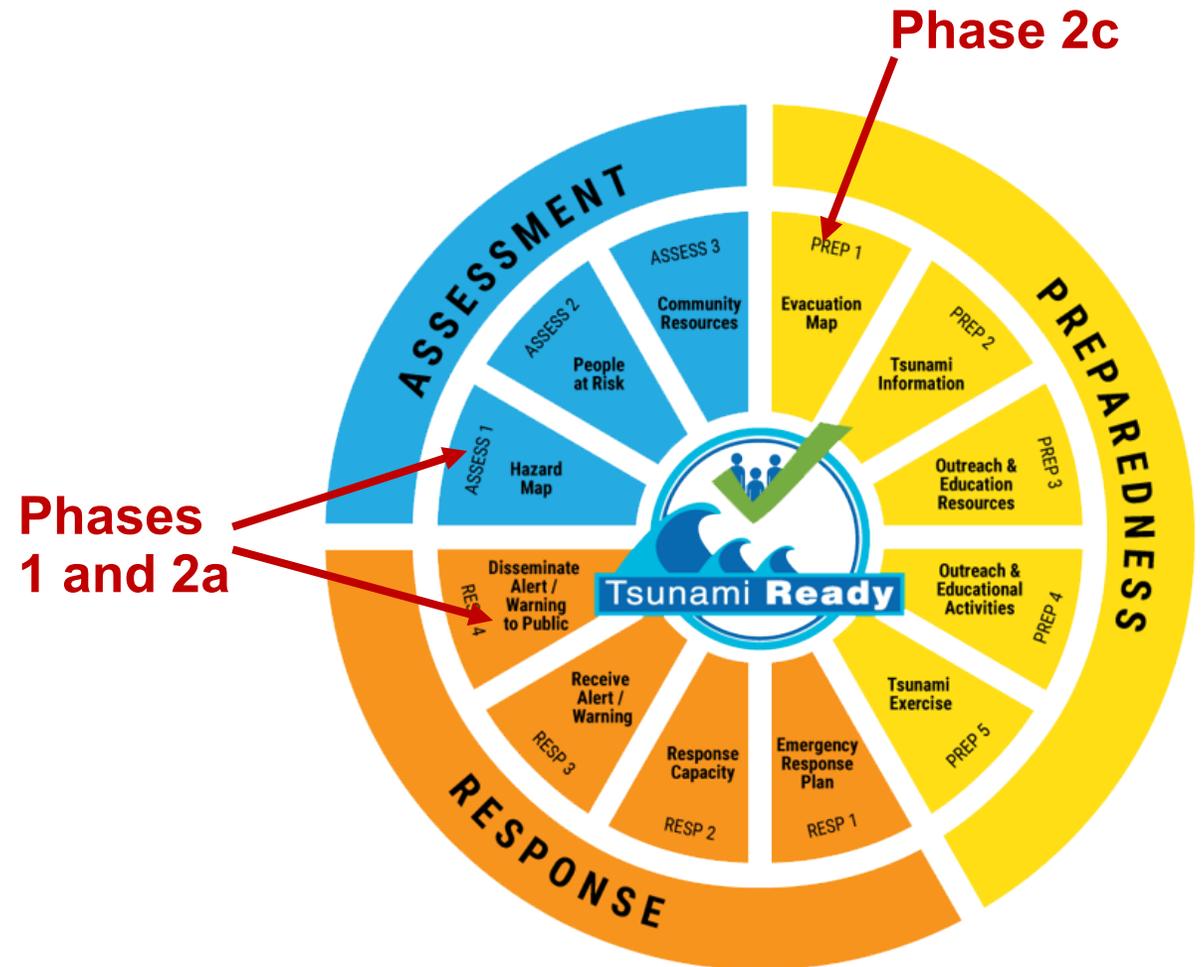
Tsunami Ready consist of 12 key indicators designed to strengthen local tsunami risk reduction capacity.

The indicators are group into three categories:

1. *Assessment*
2. *Preparedness*
3. *Response*

## Notes

- Phase 3 proposal to be submitted mid 2025 after the external evaluation
- Proposal to include Maldives (IO SIDS)



# Tsunami Ready Implementation in Pilot Sites

*Phase 3: Proposed for (2025-2027)*



**Gwadar - Pakistan**



**Chabahar - Iran**



**Kerala - India**



**Male - Maldives**



**Karachi - Pakistan**



**Jask - Iran**



**Gujarat - India**



**Dhifushi - Maldives**



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**THANK YOU**